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Climate sensitivity of *Pinus nigra* trees from the Turkish lake district

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Background

The ancient city of **Sagalassos**, situated in the Turkish lake district, has been the subject of archaeological research for the last two decades, with a focus on **nature-society interactions** over times through interdisciplinary research.

One of the points of interest is the study of climate in the past. Paleo-ecological records show a number of **vegetation shifts** since late Roman times that are suspected to be climate-driven. Tree-ring based climate reconstruction can provide additional insight into past climatic and environmental changes in the area.

In this poster we present preliminary results of our dendroclimatological research in the region.

Material and Methods

162 *Pinus nigra* and **200 *Juniperus excelsa*** trees were sampled from 6 sites (Fig. 1) at tree-line altitude (1570-2130 masl), some dating back to 1300 AD.

Fig.1: Location of the ancient city of Sagalassos (star), the 6 sampling sites (circles) and meteorological stations (diamonds)

Tree ring width (TRW) is **measured** and samples are **crossdated** following standard procedures. As this work is still ongoing, we present preliminary results from two sites: **YAK** and **SAN**. Both time series are detrended with a **negative exponential curve**. The detrended series are averaged to form two site chronologies (Fig. 2).

The series are **calibrated** against contemporary climate data from weather stations (Isparta(1931-2013), Seydisehir(1961-1990) and Beysehir(1961-1990)) and from gridded data (CRU(1901-2013; Mitchel & Jones, 2005) and EOBS(1950-2013; Haylock et al. 2008)). Pearson correlation coefficients between tree ring width and temperature, precipitation as well as drought indices (PDSI (1901-2012; van der Schrier et al., 2006) and SPEI (1901-2013, based on CRU data, calculated with the Thornthwaite (1948) equation) are calculated.

Results

The resulting chronologies are considered reliable back to 1633 for YAK and 1832 for SAN (EPS>0.85, Fig. 2).

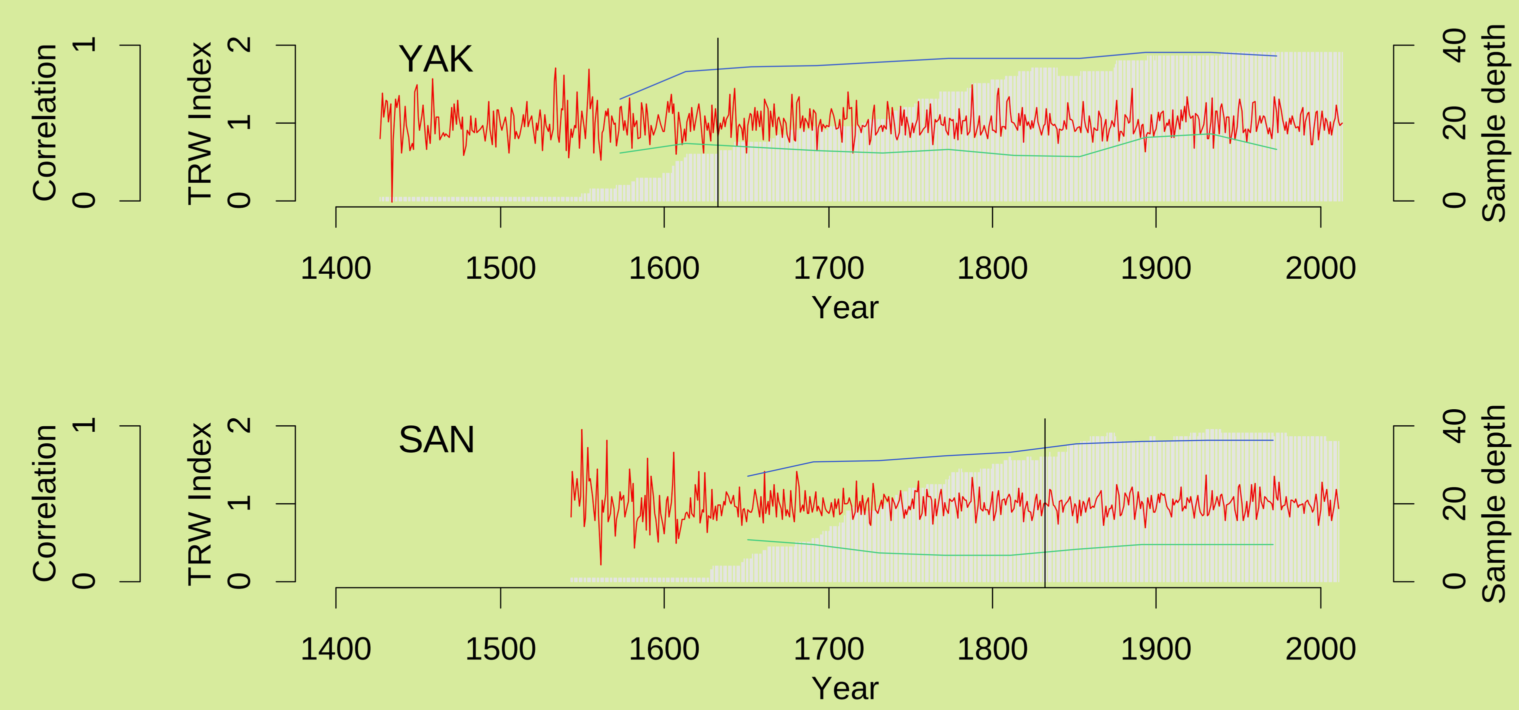

Fig.2: Detrended chronologies (red) with sample depth (grey), running expressed population signal (EPS, blue) and inter-series correlation (rbar, green). Vertical lines indicate the cutoff year with EPS=0.85

-TRW negatively correlates with **June temperature** (Fig.3)
-TRW positively correlates with **May/June precipitation**
-TRW responds particularly strong to **May/June SPEI**

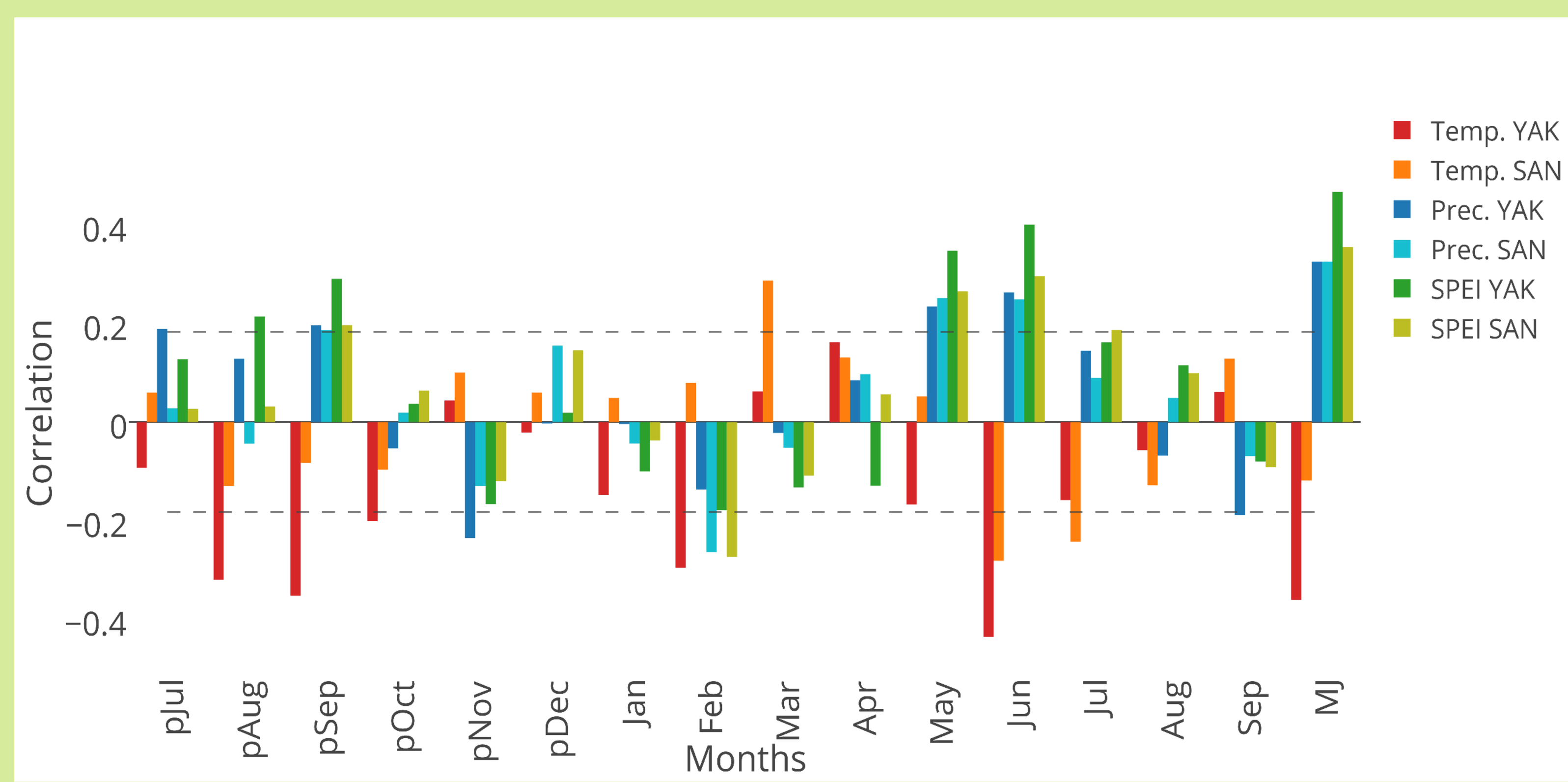

Fig.3: Correlation coefficients between TRW and monthly CRU temperature, precipitation and SPEI. Calculations are made over the full climate data period (1902-2011). Dashed lines represent the significance level p<0,05.

Conclusion and Outlook

Each of the chronologies contains strong and temporarily robust common variation (high rbar and eps). Comparison of the TRW data with precipitation, temperature and drought series indicates that these trees respond to late spring/early summer drought.

Data from additional trees & sites are expected to improve the regional climate signal in tree-ring width. Stable isotope analysis and density measurements on a selection of samples are under way and possibly further improve both the strength of drought (isotopes) and temperature (density) signals. We hope that this will allow for robust climate reconstructions over the last centuries.

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Visit www.sagalassos.be for more information on the Sagalassos Archaeological Research Project

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